

Appln. No. 10/706,645
Amendment dated January 29, 2007
Reply to Final Office Action of November 28, 2006

REMARKS

Applicants acknowledge receipt of the Final Office Action dated November 28, 2006.

Applicants appreciate the clarification on two additional rejections that the Examiner provided to the undersigned during a phone conversation on January 24, 2007. The Examiner confirmed that Claims 1, 3-7, 9-11, 13-17, 19-25 were rejected under 35 U.S.C. §103(a) (and not under 102(b)) as being unpatentable over the combination of U.S. Patent 6,015,285 (hereinafter *McCarty*) in view of U.S. Patent 6,830,596 (hereinafter *Deckman*) and U.S. Patent 4,906,176 (hereinafter *Yamashita*); and that additionally, Claims 2, 8, 18, 40-49, 76-77, 80-81, 83-90 were rejected under 35 U.S.C. §103(a) over the same combination of references. As such, these rejections on these claims could be addressed together.

Furthermore, Claim 12 was rejected under 35 U.S.C. §103(a) as being unpatentable over *McCarty* in view of *Deckman*, *Yamashita* and further in view of U.S. Patent 4,793,797 (hereinafter *Kato*). Claim 40 was also rejected under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicants regard as the invention.

The undersigned appreciates the time the Examiner took to discuss *Deckman*'s teachings and lack thereof during a telephone conversation on January 26, 2007.

Applicants respectfully traverse each of these rejections and respectfully request the entry of the claim amendment, the withdrawal of all rejections for immediate allowance.

I. Status of the Claims

In this response, Claim 40 (under examination) and Claim 50 (withdrawn) were amended. Withdrawn Claim 50 was amended in the same manner as amended Claim 40.

Claims 1-9, 11-13, 16-35, 37-40, 42-55, 57, 58, 60-74, 76-81 & 83-90 are currently pending in the case, in which Claims 1-9, 11-13, 16-25, 76 & 77 covering a catalyst support; Claims 40-49, 80, 81 & 83-85 covering a partial oxidation catalyst and Claims 86-90 covering a partial oxidation catalyst are under examination, and Claims 26-35, 37-39, 50-55, 57-58, 60-74, 78-79 stand withdrawn from examination as non-elected claims from a restriction requirement dated January 25, 2006.

II. Rejection under 35 U.S.C. § 112¶ 2

In the Office Action dated November 28, 2006, Claim 40 was rejected as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicants regard as the

Appln. No. 10/706,645

Amendment dated January 29, 2007

Reply to Final Office Action of November 28, 2006

invention. It is stated on Page 4 of in the Office Action that it is not clear whether rhodium is necessarily present in the catalyst as evidenced by the Markush group in which the metal selected could be another metal other than rhodium. As a result, Claim 40 was treated as though rhodium is necessarily present in the catalyst in the claimed amount.

Applicants acknowledge that the language of Claim 40 may not be as clear as it could be, but Applicants believe that the narrowing interpretation of such claim is erroneous for at least two reasons. First, according to MPEP 2111.01, the claims must be interpreted as broadly as their terms reasonably allow during examination; the broadest interpretation of Claim 40 is that the active ingredient does not necessarily contain rhodium, but that the active ingredient comprises either a metal selected from the Markush group (including rhodium) or a rhodium alloy. Second, the narrowing interpretation of Claim 40 to require rhodium in the catalyst composition would render independent Claim 40 with a similar scope as independent Claim 86, in which rhodium is required in the catalyst in the same claimed amount; as a result, the interpretation of independent Claim 86 would be challenging in view of the narrowed interpretation of independent Claim 40.

Thus, Applicants amended element (a) of Claim 40 to clarify that rhodium is not necessarily present in the catalyst, and that only when the active ingredient contains rhodium, rhodium content in the catalyst is limited to the claimed range.

“... (a) an active ingredient comprising a rhodium alloy or a metal selected from the group consisting of rhodium, iridium, ruthenium and combinations thereof, *wherein, when the active ingredient comprises rhodium, said rhodium is in an amount of from about 0.1 wt% to about 20 wt% based on the total catalyst weight;...*” [emphasis added]

With the present amendment of Claim 40, Claim 40 now clearly has the broadest reading that was intended in the original claim for the composition of the active ingredient in the catalyst, and it should be clear to one having ordinary skill in the art from the reading of such claim what is claimed.

Applicants thus believe that the amendment of Claim 40 cures the indefiniteness issue and respectfully requests the Examiner to withdrawn the 35 U.S.C. § 112 ¶ 2 rejection on such claim.

III. Rejection under 35 U.S.C. § 103(a) over *McCarty* in view of *Deckman* and *Yamashita*

Claims 1-11, 13-25, 40-49, 76-77, 80-81 and 83-90 were rejected under 35 U.S.C. § 103(a) as being unpatentable over *McCarty* in view of *Deckman* and *Yamashita*.

Appln. No. 10/706,645

Amendment dated January 29, 2007

Reply to Final Office Action of November 28, 2006

Applicants respectfully traverse the Examiner's rejection, as the combination of *McCarty* with *Deckman* and *Yamashita* fails to teach all of the limitations of independent Claims 1, 40 and 86 and *a fortiori* of their respective rejected dependent Claims 2-11, 13-25, 41-49, 76-77, 80-81, 83-85 and 87-90. In addition, there is no motivation to modify the support and the catalyst disclosed by *McCarty* by the teachings of *Deckman* and *Yamashita*.

Independent Claims 1, 40 and 86 require that the catalyst support comprises three distinct crystalline phases: an (α and/or θ) alumina phase; a rare earth aluminate of a hexaaluminate or hexaaluminate-like structure; and a rare earth aluminate of a perovskite or perovskite-like structure in the catalyst support.

On Page 5 of the Final Office Action dated November 28, 2006, the Examiner has stated that *McCarty* discloses the combination of alumina and hexaaluminate, the use of α -alumina in a diffusion layer and the individual use of hexaaluminate and perovskite in the support. The Examiner also acknowledged that *McCarty* does not teach the combination of an (α and/or θ) alumina phase, a rare earth aluminate of a hexaaluminate or hexaaluminate-like structure, and a rare earth aluminate of a perovskite or perovskite-like structure in the catalyst support, but has used *Deckman* to provide the combination of hexaaluminate and perovskite in a catalyst support by pointing to Col. 6 lines 24-37 in *Deckman*. Applicants note that this is the first time that the *Deckman* reference is cited against the present claimed invention, and thus it is the first time that the Applicants can discuss its teachings in combination with those of *McCarty*.

Applicants understand that one cannot show nonobviousness by attacking the references individually when the rejections are based on a combination of references. However, Applicants believe that some of the teachings of *McCarty* and *Deckman* have been misinterpreted, and Applicants would like to point out what these individual references fail to teach before their combined teaching is discussed in view of this obviousness rejection.

Addressing first the teachings of *McCarty*, it is said on Page 5 of the Office Action that in *McCarty* Col. 3 lines 25-31 (see reproduced below), the support comprises lanthanum oxide hexaaluminate and lanthanum oxide alumina hexaaluminate (thus meeting the limitation wherein hexaaluminate and alpha-alumina or theta-alumina comprises the support).

Appln. No. 10/706,645

Amendment dated January 29, 2007

Reply to Final Office Action of November 28, 2006

"...The first zone combustion catalyst comprises palladium oxide dispersed on a support selected from the group consisting of La_2O_3 -stabilized $\gamma\text{-Al}_2\text{O}_3$, La-stabilized $\gamma\text{-Al}_2\text{O}_3$, Ce-stabilized $\gamma\text{-Al}_2\text{O}_3$, Ba-stabilized $\gamma\text{-Al}_2\text{O}_3$, and $\text{La}_2\text{O}_3\cdot 11\text{Al}_2\text{O}_3$ hexa-aluminate. The second zone combustion catalyst is selected from the group consisting of $\text{La}_{0.5}\text{Sr}_{0.5}\text{MnAl}_{11}\text{O}_{19}$, PdO on $\text{La}_2\text{O}_3\cdot 11\text{Al}_2\text{O}_3$ hexa-aluminate, and $\text{La}_{0.2}\text{Sr}_{0.8}\text{MnAl}_{11}\text{O}_{19}$ with Pt." [McCarty Col. 3 lines 25-31]

However, an artisan reading such passage (which is reproduced above and is consistent with the abstract of *McCarty*) would understand that the support may be selected from a stabilized γ -alumina, a lanthanum hexaaluminate or a substituted lanthanum aluminate composite (e.g., $\text{La}_{0.2}\text{Sr}_{0.8}\text{MnAl}_{11}\text{O}_{19}$). However, there is no teaching from *McCarty* that the support may be selected from a combination of the distinct crystalline phases of hexaaluminate and (α - and/or θ -) Al_2O_3 . Indeed, the ' $\text{La}_2\text{O}_3\cdot 11\text{Al}_2\text{O}_3$ hexa-aluminate' in *McCarty*'s reproduced passage does not teach the combination of the two distinct hexaaluminate and alumina crystalline phases, but instead, the ' $\text{La}_2\text{O}_3\cdot 11\text{Al}_2\text{O}_3$ ' formula merely discloses the chemical composition of the lanthanum hexaaluminate. Thus, *McCarty* solely teaches individual use of stabilized γ -alumina, lanthanum hexaaluminate or some substituted lanthanum aluminate composites in the support, but fails to teach the combination of an (α and/or θ) alumina phase and a hexaaluminate in a support.

With respect to the teaching of lanthanum weight content in the support of *McCarty*, a lanthanum hexaaluminate support of formula $\text{La}_2\text{O}_3\cdot 11\text{Al}_2\text{O}_3$ has a La weight content of *ca.* 19 wt% and a lanthanum aluminate perovskite support of formula LaAlO_3 has a La weight content of *ca.* 65 wt%. Consequently, contrary to the Examiner's statement, these supports do not teach the lanthanum weight percent between about 1 and about 10 wt%. With a 11:1 molar ratio of La to Al in a lanthanum hexaaluminate and a 1:1 molar ratio of La to Al in the lanthanum aluminate perovskite, the weight percents are indeed calculated as follows with La of M.W. 139 g/mol, La_2O_3 of M.W. 326 g/mol, O of M.W. 16 g/mol, Al of M.W. 27 g/mol and Al_2O_3 of M.W. 102 g/mol (where M.W. represent the molecular weight):

per mole of $\text{La}_2\text{O}_3\cdot 11\text{Al}_2\text{O}_3$:

$$\frac{2 \text{ mol La} \times 139 \text{ g La/mol La}}{1 \text{ mol La}_2\text{O}_3 \times 326 \text{ g/mol La}_2\text{O}_3 + 11 \text{ mol Al}_2\text{O}_3 \times 102 \text{ g/mol Al}_2\text{O}_3} \approx 19.2 \text{ wt\% La}$$

per mole of LaAlO_3 :

$$\frac{1 \text{ mol La} \times 139 \text{ g La/mol La}}{1 \text{ mol La} \times 139 \text{ g/mol La} + 1 \text{ mol Al} \times 27 \text{ g/mol Al} + 3 \text{ mol O} \times 16 \text{ g/mol O}} \approx 65 \text{ wt\% La}$$

Appln. No. 10/706,645

Amendment dated January 29, 2007

Reply to Final Office Action of November 28, 2006

With respect to the teaching of α -alumina, *McCarty* only discloses the use in this material as a diffusion barrier layer in the catalyst composition (see Table 1 on Col. 5 line 29 and Table 2 on Col. 8 line 9). This second layer is *applied over* the catalytic layer (see Col. 7 lines 66-67 and Col. 8 lines 32-34). Thus, *McCarty* fails to teach that α -alumina *supports* the catalytic ingredient. Accordingly, the function of the α -alumina in *McCarty*'s catalyst differs from that of α -alumina in Applicants' claimed compositions.

In summary, *McCarty* as a whole teaches the individual use of perovskite and hexaaluminate as support for a combustion catalyst. *McCarty* further fails to teach the combination of an (α and/or θ) alumina phase and a hexaaluminate in a support; the use of α -alumina in the support of *McCarty*'s catalyst composition; and the lanthanum weight percent between about 1 and about 10 wt%.

Second, addressing the teachings of *Deckman*, *Deckman* was used by the Examiner to provide the combination of hexaaluminate and perovskite in a catalyst support, since such limitation is missing from *McCarty*. Applicants disagree with the interpretation of *Deckman*'s teaching concerning the composition of the support in the hydrogen combustion catalyst identified by the Examiner in *Deckman* Col. 6 lines 24-37.

"... More preferred support materials include Al_2O_3 , TiO_2 , and ZrO_2 , especially as stabilized, for example with rare-earth oxides. Also more preferred are hexaaluminate supports including $\text{LaAl}_{11}\text{O}_{18}$, (more generally $\text{MAl}_{11}\text{O}_{18}$, where M is an element or mixture of elements, for example including La, Ba, Mn, Al or, Sr). Also more preferred are perovskite supports such as LaCrO_3 (more generally $\text{M}_1\text{M}_2\text{O}_3$, where M1 and M2 are each an element or mixture of elements, for example including Fe, Ni, Co, Cr, Ag, Sr, Ba, Ti, Ce, La, Mn, Zr). Substituted hexaaluminate, perovskite, or mixed metal oxide supports may, in themselves, provide adequate catalytic activity for high temperature oxidation of hydrogen. Alternatively, a catalytic agent may be dispersed onto the support." [*Deckman*. Col. 6 lines 24-37]

An artisan reading such passage (which is reproduced above) would interpret that the support material in *Deckman* may be a stabilized Al_2O_3 , a stabilized TiO_2 , a stabilized ZrO_2 , an hexaaluminate material or a perovskite material. However, there is no teaching from *Deckman* of the use of a *combination* of these materials in the support of a hydrogen combustion catalyst. The following phrase "[s]ubstituted hexaaluminate, perovskite, or mixed metal oxide supports" in *Deckman* Col. 6 lines 34-35 does not teach the mixture of substituted hexaaluminate and perovskite, but merely lists additional forms of mixed metal oxide materials other than the mixed metal oxide composites that are represented by substituted hexaaluminates and perovskites. This interpretation is further supported by a

Appln. No. 10/706,645

Amendment dated January 29, 2007

Reply to Final Office Action of November 28, 2006

sentence (in *Deckman* Col. 6 lines 18-20) which is located above the above passage that states: "...catalyst may take the form of a *single mixed-metal oxide formulation*, such as a substituted perovskite or hexaaluminate." [*italic added*]

As such, the modification of *McCarty* with *Deckman* as suggested by the Examiner to provide the combination of the three crystalline phases in the catalyst support as recited in the independent Claims 1, 40 and 86 of the present application fails for at least these reasons:

1/ both references solely teach the individual use of hexaaluminate or perovskite *as the support material*, not their combination in a support;

2/ neither references teach the combination of hexaaluminate and α -alumina in a support material;

3/ α -alumina in *McCarty*'s catalyst is not taught to support the active metal but to coat it to create a mass transfer resistance layer on top of the catalytic layer to prevent overheating of the catalyst structure; and furthermore, there is no motivation from *McCarty* to use α -alumina in the support, as the addition of α -alumina to the support of *McCarty*'s catalyst is not consistent with *McCarty*'s teaching of what the support should provide (i.e., high surface area for dispersion of the catalytic ingredient in *McCarty* Col. 7 lines 44-77 & lines 58-59) – indeed α -alumina is known by the artisan to have very low surface area of a few meter squares per gram; and finally

4/ there is no indication from either reference that it would be desirable to combine an α and/or θ alumina phase, an hexaaluminate phase and a perovskite phase in a support.

Applicants therefore assert that since *Deckman* fails to provide what is missing from *McCarty*, *Deckman* cannot be relied upon to remedy the deficiencies of *McCarty*, and as a result the combination of *McCarty* with *Deckman* and *Yamashita* cannot provide the catalyst support with the combination of the three crystalline phases as recited in all of the rejected claims.

Yamashita was not relied upon to provide the combination of the three crystalline phases in the support, but the Examiner has used *Yamashita* to provide other teachings in a catalyst support in which *McCarty* was deficient, such as: an alpha-alumina content of not ore than 20%; percentage by weight of the rare earth aluminate with high molar ratio, the intimate mixture of the alumina phase and the rare earth aluminate with high molar ratio; the claimed surface area and the active ingredient

Appln. No. 10/706,645
 Amendment dated January 29, 2007
 Reply to Final Office Action of November 28, 2006

in the catalyst comprising rhodium or an alloy thereof (on Pages 6 and 7 of the Final Office Action of November 28, 2006).

Notwithstanding that *Deckman* fails to complement the missing limitation of the combinations of the hexaaluminate phase, the perovskite phase and the alumina phase in the support, *Yamashita* also fails to provide some of these additional elements missing from *McCarty*. For example, *Yamashita* does not provide the maximum α -alumina in Col. 7 lines 15-20, contrary to what is stated in the Final Office Action.

“... A slurry of the powder containing the composite oxide may be applied [...] to an inorganic heat-resistant support such as [...] α -alumina, [...] in various shapes to form a coating. The amount of the composite oxide to be supported on the inorganic heat-resistant support is at least 5%, preferably 5 to 30%, based on the total weight of the support. ...” [*Yamashita* col. 7 lines 11-20]

When the composite oxide which comprises L- β -alumina is supported on a heat-resistant refractory oxide such as α -alumina, *Yamashita* discloses that the amount of the composite oxide to be supported on α -alumina is at least 5% based on the total weight of the support, preferably 5 to 30% (that is to say, 5 g composite oxide per 100 g of α -alumina to 30 g composite oxide per 100 g of α -alumina). In view of the preferred range of 5-30%, the α -alumina content in the combined α -alumina + composite oxide is between about 95 % (= 100 g ÷ (100 g + 5 g)) and 77% (= 100 g ÷ (100 g + 30 g)). *Yamashita* teaches an α -alumina content well above the maximum 20% as required in Claim 1 and its rejected dependent claims.

Yamashita also discloses the poorer performance of the Pd catalyst supported on α -alumina. See *Yamashita* Figure 5 curve 21 and Col. 11 line 15. *Yamashita* further discloses an issue on failure of this catalyst to ignite the reactant mixture in a methane combustion test. See *Yamashita* Col. 11 line 51-52. It is to be noted that *McCarty* clearly does not regard the previous combustion catalysts as commercially successes (presumably including *Yamashita*'s catalyst since it predates *McCarty* by about a decade), as they fail to provide durable high temperature combustion operation (see *McCarty* Col 2 lines 63-65). Thus, in view of the denigration of *McCarty*'s of previous combustion catalysts, the expected poorer performance of oxidation catalysts using α -alumina as a support, and further the need by *McCarty* for maintenance of catalytic metal dispersion for a longer period of time, it is doubtful that an artisan would look at catalyst disclosures predating *McCarty* to modify *McCarty*'s catalyst by adding α -alumina into the support composition with an expectation of improved endurance and/or performance.

Appln. No. **10/706,645**
Amendment dated January 29, 2007
Reply to Final Office Action of November 28, 2006

For at least the reasons stated above, the combination of *McCarty* with *Deckman* and *Yamashita* does not teach all of the limitations of independent Claims 1, 40 and 86, and *a fortiori* also of their respective dependent Claims 2-11, 13-25, 41-49, 76-77, 80-81, 83-85 and 87-90, which were rejected on the same basis, and furthermore, there is no motivation from *McCarty* to use α -alumina in the support, as the addition of α -alumina to the support of *McCarty*'s catalyst is not consistent with *McCarty*'s teaching of what the support should provide.

Applicants submit that the combination of these references fails to provide a *prima facie* case of obviousness as required by MPEP 2143.03, and further believe that Claims 1-11, 13-25, 40-49, 76-77, 80-81 & 83-90, are patentable over the combination of *McCarty* with *Deckman* and *Yamashita*.

Applicants respectfully request that the Examiner withdraw the § 103 rejection on such claims.

IV. Rejection Under 35 U.S.C. § 103(a) over *McCarty* in view of *Deckman*, *Yamashita* and *Kato*

Claim 12 was rejected under 35 U.S.C. § 103(a) over *McCarty* in view of *Deckman*, *Yamashita* and *Kato*. Applicants respectfully traverse the rejection and submit that the combination of *McCarty* in view of *Deckman* and *Yamashita* fails to teach all of the elements of Claim 1 from which Claim 12 depends, and further submit that *Kato* fails to provide the missing limitations from *McCarty* or its combination with *Deckman* and/or *Yamashita*.

Thus, Applicants respectfully request the Examiner to withdraw the 103 rejection of such claim for lack of *prima facie* (as required by MPEP 2143.03).

V. Withdrawn claims of non-elected Groups II and III

Claims 26-39 and 78-79 covering a method of making a catalyst support and Claims 50-75 and 82 covering a method for making synthesis gas using a catalyst were withdrawn as non-elected claims of Group II and Group III, respectively, as identified in the Restriction Requirement dated January 25, 2006.

By this amendment, Claim 50 is amended to reflect the same amendment to the active ingredient in the catalyst composition of Claim 40, in order for the withdrawn independent Claim 40 to carry all of the limitations pertaining to the catalyst composition of currently-amended Claim 40 which Applicant believes is allowable.

Appln. No. 10/706,645
Amendment dated January 29, 2007
Reply to Final Office Action of November 28, 2006

In the Final Office Action (Page 3), Applicants have noted the Examiner's statement on the applicability of rejoinder of these withdrawn claims based on MPEP §821.04(b), and will be very appreciative of his reconsideration about the rejoinder in view of the following amendment and arguments above.

VI. Conclusion

Applicants believe that this submission fully responds to the Final Office Action dated November 28, 2006. Applicants submit that *prima facie* cases of obviousness based on the combination of *McCarty* with *Deckman* and *Yamashita* for Claims 1-11, 13-25, 40-49, 76-77, 80-81 and 83-90 and based on the same combination further in view of *Kato* for Claim 12 were not properly set forth. As such, Applicants believe that all pending claims are patentable over the art of record.

Applicants respectfully requests the amendment of Claim 40 to be considered as it is believed that such amendment overcomes the indefiniteness rejection on this claim. Applicants respectfully request the entry of the claim amendment, as Applicants believe that *no new matter was introduced* by way of amendment to the claims; and that the amendment *does not raise new issues* that would require further consideration and/or search.

Furthermore, based on MPEP §821.04, Applicants believe that withdrawn Claims 26-35, 37-39, 50-55, 57-58, 60-74 & 78-79 should be rejoined, for they contain the allowable subject matter contained in the examined independent claims 1 and 40 and are free from 35 U.S.C. §101 or §112, first paragraph issues.

Applicants believe that what has been presented should be fully persuasive for allowability. Favorable action at the Examiner's earliest convenience is respectfully solicited.

However, should there be any remaining issue which the Examiner believes would possibly be resolved by a conversation or should the Examiner would like to suggest critical language to put this application in condition for immediate allowance, the Examiner is invited to call the undersigned at (281) 293-4751 so that further delay in a Notice of Allowance can be avoided.

Also, if the Examiner is not persuaded that the Application is in condition for allowance and further does not believe that whatever issues remaining can be resolved by a telephone interview, the Examiner is requested to at least approve entry of the claim amendment as it will clearly put this Application in better form for appeal by reducing issues for appeal.


Appln. No. **10/706,645**
Amendment dated January 29, 2007
Reply to Final Office Action of November 28, 2006

Should any fees have been inadvertently omitted, or if any additional fees are required or have been overpaid, please appropriately charge or credit those fees to **Deposit Account Number 16-1575 of ConocoPhillips Company**, Houston, Texas, and consider this a petition for any necessary extension of time.

Respectfully submitted,

CONOCOPHILLIPS COMPANY - IP LEGAL

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